

Claims

1. Apparatus for producing an extrudate product, the extrudate product including a plurality of capillary channels therethrough, the apparatus comprising an extruder having an inlet, a die including an orifice having a predetermined outer shape, a plurality of needles each having a body including an internal conduit for fluid flow, each needle further comprising an outlet from the internal conduit at an outlet end, the outlet end of each needle being arranged in a predetermined pattern substantially within the orifice of the die, the conduit of each needle being fluidly connected to a fluid source, wherein, in use:

15 a) extrudable material is fed into the extruder through the inlet;

b) the extruder forces the extrudable material around the bodies of the needles towards the die and through the orifice in the die to produce an extrudate having the predetermined outer shape;

20 c) the needles allow fluid to be drawn from the fluid source through the conduit to be entrained in the extrudate product to form capillaries such that the extrudate product includes capillaries therealong in the predetermined pattern.

2. Apparatus as claimed in claim 1, in which the outlets from the needles are regularly distributed within the orifice.

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3. Apparatus as claimed in claim 1 or claim 2, in which

the die orifice is substantially rectangular having two long edges and two short edges.

4. Apparatus as claimed in claim 3, in which the needles
5 are arranged in a single line of needles substantially parallel with a long edge of the rectangular orifice.

5. Apparatus as claimed in claim 4, in which the line of
needles is arranged substantially centrally in the
10 orifice.

6. Apparatus as claimed in any preceding claim, in which
the fluid source has a pressure substantially equal to
that of the environment at the outlet of the die.

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7. Apparatus as claimed in claim 6, in which the fluid
source is air from the atmosphere and the extrudate is
extruded into the atmosphere.

20 8. Apparatus as claimed in any preceding claim, in which
the apparatus further comprises a gear pump between the
extruder and the die.

9. Apparatus as claimed in any preceding claim, in which
25 the die is a converging die.

10. Apparatus as claimed in any preceding claim, in which
the apparatus further comprises draw down apparatus to
draw down the extrudate.

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11. A method for producing an extrudate product including

a plurality of capillary channels therealong, the method comprising the steps of:

- a) providing an extrusion apparatus comprising an extruder having an inlet, a die including an orifice
5 having a predetermined outer shape, a plurality of needles each having a body including an internal conduit for fluid flow, each needle further comprising an outlet from the internal conduit at an outlet end, the outlet end of each needle being arranged in a predetermined pattern
10 substantially within the orifice of the die, the conduit of each needle being fluidly connected to a fluid source;
- b) feeding extrudable material into the extruder through the inlet;
- c) using the extruder to force the extrudable
15 material towards the die and through the orifice in the die to produce an extrudate having the predetermined outer shape;
- d) using the needles allow fluid to be drawn from the fluid source through the conduit to be entrained in the
20 extrudate product to form capillaries such that the extrudate includes capillaries therealong in the predetermined pattern.

12. A method as claimed in claim 11, in which the method
25 includes the additional step of drawing down the extrudate using draw down apparatus.

13. A method as claimed in claim 11 or claim 12, in which the method further comprises the step of laminating two or
30 more films together.

14. A method as claimed in claim 13, in which the two or more films are laminated together using heat and pressure.